Distributed Generator Project: Inventory and Case Studies

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What types of DG applications are there?

- Emergency
  - Engine used to produce electricity during grid failure or other emergency (typically less than 300 hrs/yr)
- Peak Shaving
  - Engine used during peak demand, to reduce demand charges on electricity bill (defined by purpose instead of hours of use, but usually under 700 hrs/yr)
- Baseload
  - Engine used for full time power because it can provide increased power reliability, quality and (typically more than 700 hrs/yr) predictable costs

Why is NESCAUM interested in DG?

- Increased use of diesel engines due to:
  - Expanding demand for electricity
  - Transmission constraints
  - Increasing incentives: ISO programs, real-time pricing
- Threat to air quality
  - Diesel → PM, NOx, CO, organic compounds
  - Generators pose a significant threat in urban areas
- Unknown population, desire to know how many are permitted

The NESCAUM DG Project

- Designed to answer the following questions:
  - How many IC engines are located in the Northeast States?
  - How many are diesel?
  - How often are they used?
  - How will future use change due to ISO program incentives and increased demand for electricity?
  - What are the emissions associated with these engines?
  - What control technologies are available, and what are their costs?
  - What policy options are available to the states in order to address the issue?

NESCAUM DG Project Outline

1. Inventory of the eight NESCAUM states
   - gather state permitting data
   - compare to estimates based on population modeling
2. Survey of areas facing transmission constraints
   - New York City
   - Fairfield County, CT
3. Emissions estimates
   - current use, predict future use
4. Case studies for PM and NOx control technologies
5. Policy summary and recommendations

State Inventory Methodology

- Power Systems Research (PSR) provided estimates of diesel IC engine populations for each state
  - Used national sales data, distributed to the state level using statistical assumptions
- State Permitting Information
  - NESCAUM requested lists of permitted IC engines from the air quality control divisions of all eight states
  - The engines were sorted to remove those which were not included in PSR's estimate

State Inventory Results

ENGINES WITH PERMITS IN THE NORTHEAST STATES

	CT	ME	MA	NH	NJ	NY	RI	VT	TOTAL
25-50 kW	112	2	11	1	4	26		0	**156**
50-100 kW	208	78	13	2	132	93		9	**535**
100-250 kW	411	184	278	70	1,485	337		18	**2,783**
250-500 kW	321	158	156	129	1,337	410		17	**2,528**
500-750 kW	273	64	138	72	971	272		7	**1,797**
750-1000 kW	144	28	73	40	853	201		2	**1,341**
1000-1500 kW	153	36	160	48	725	175		10	**1,307**
1500+ kW	99	28	275	9	568	148		3	**1,130**
Total Permitted Engines	**1,721**	**578**	**1,104**	**371**	**6,075**	**1,662**	**73**	**66**	**11,650**
Total PSR Estimates	**3,223**	**560**	**5,027**	**743**	**8,415**	**15,037**	**363**	**310**	**33,678**
% Permitted/PSR Est.	**53%**	**103%**	**22%**	**50%**	**72%**	**11%**	**20%**	**21%**	**35%**
% Permitted < 500 kW	**40%**	**96%**	**11%**	**35%**	**42%**	**7%**	**--**	**16%**	**22%**
% Permitted > 500 kW	**110%**	**131%**	**73%**	**98%**	**219%**	**30%**	**--**	**61%**	**94%**

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Current State Permitting Requirements

STATE	GENERAL PERMITS (pre-construction permits)	EMERGENCY GENERATOR PERMIT	DEMAND RESPONSE RESTRICTIONS
CT	> 15 TPY (approx. > 75 kW), 37 kW in SW CT	permit-by-rule: no registration, but emissions req. (< 5 TPY) and < 500 hr/yr, only in emergency	SW CT emerg. add'l 300 hrs/yr for emergency demand response, no price reponse by emer. engines
ME	> 500 kW for all, > 50 kW if at facility with > 500 kW	< 500 hrs/yr if > 50 kW	no restrictions beyond hour limit for emergency engines
MA	> 1 MW for all, > 300 kW if non-emergency	> 300 kW - 1 MW permit-by-rule, < 300 hrs/yr	no price response for emergency permitted engines
NH	> 25 TPY and/or > 150 kW	< 500 hrs/yr	neither type of demand response for any emergency engines
NJ	> 100 kW	< 500 hrs/yr (or equivalent fuel)	no demand response (emergency or price) by emergency engines; non-emergency engines must have SOTA technology or < 5 TPY emissions
NY	state: > 160 kW in NYC, > 300 kW elsewhere; city: > 33 kW diesel, > 280 kW all fuels	state: < 500 hrs/yr, no permits; city: no hr restrictions, > 280 kW must register, but no permit req.	emergency engines may participate 200 hrs/yr for emergency DR, diesels must have 30 ppm; no price response for any emer. engines; no diesel engines in price response program
RI	> 500 kW, > 100 kW at a major source	< 500 hrs/yr if > 100 kW, if diesel 0.3% sulfur fuel	no restrictions beyond hour limit and fuel specs for emergency engines
VT	> 337 kW, > 150 kW if already permits at facility	< 200 hrs/yr	neither type of demand response for emergency engines

PSR Survey Methodology

- Detailed surveys were completed for New York City and Fairfield County, CT
  - Designed to produce reliable inventories for two areas experiencing transmission constraints
  - ISO Demand Response programs in these areas provide strong incentives for customers to reduce load by running on-site generators
  - Each call identified whether an engine was present, determined the application and use, size, age, fuel, and hours of operation

New York City Survey

- PSR Survey found 1,724 engines
  - 1440 diesel, 1097 emergency
  - 58% of engines are larger than 500 kW
- The 1,724 engines reported that they generated 490,000 MWhs in the last year
  - 100,000 MWh by emergency engines
  - Without testing hours 70,000 MWh by emergency engines - average of 140 hours per engine
- Compared engines in survey to those permitted by the NYC DEP
  - Additional 453 emergency engines permitted
  - Total number of engines is 2,177

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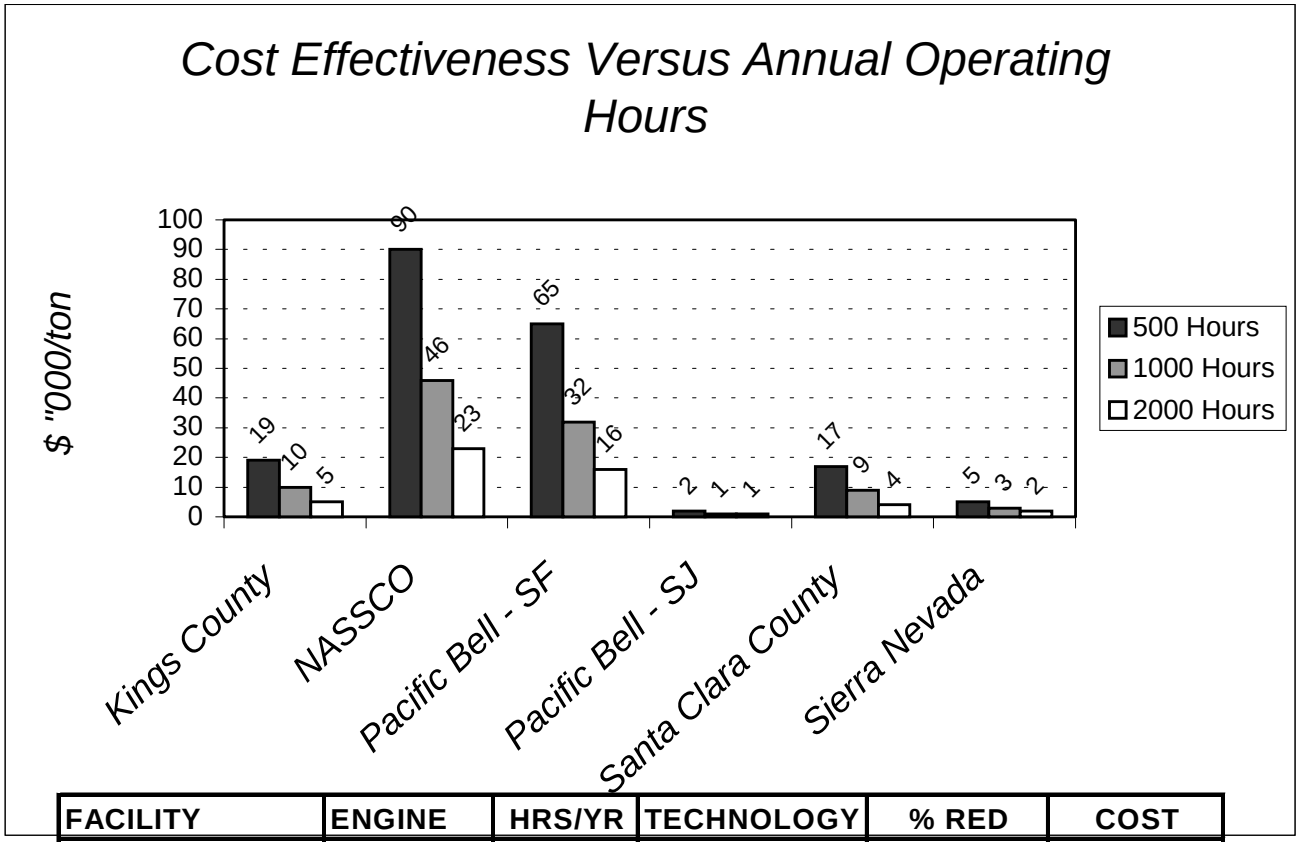
Fairfield County Survey

- PSR Survey found 294 engines
  - 195 diesel, 280 emergency
  - most engines (86%) are smaller than 500 kW
- The 294 engines reported that they generated 9,300 MWh in the last year
  - 4,500 MWh by emergency engines
  - Without testing, 900 MWh by emergency engines
- Compared engines in survey to those permitted by the CT DEP
  - Additional 255 engines permitted
  - Total number of engines is 549

Emissions Estimates

- NE-ISO Demand Response Programs
  - Emergency Demand Response Program
  - Price Response Program
    - 68 hours in 2001, over 6 days
      - for 1 MW for 68 hrs payment = $17,415
    - 166 hours in 2002, over 12 days
      - for 1 MW for 166 hrs payment = $15,234
    - in 2002, a total of 575 MWh generated through the program (add'l 434 MWh curtailed)
    - if diesel, 0.85 tons PM, 12.3 tons NOx over 12 days

Control Technology Case Studies



FACILITY	ENGINE	HRS/YR	TECHNOLOGY	% RED	COST
Kings County	2100 kW	600	DPF	85%	$121,000
NASSCO	750 kW	4,800	DPF, SCR	85%, 90%	$289,000
Pacific Bell - SF	2100 kW	20	DPF	85%	$95,860
Pacific Bell - SJ	1670 kW	20	DOC	25%	$24,895
Santa Clara	1670 kW	70	DPF	85%	$45,834
Sierra Nevada	750 kW	150	DPF	85%	$40,655

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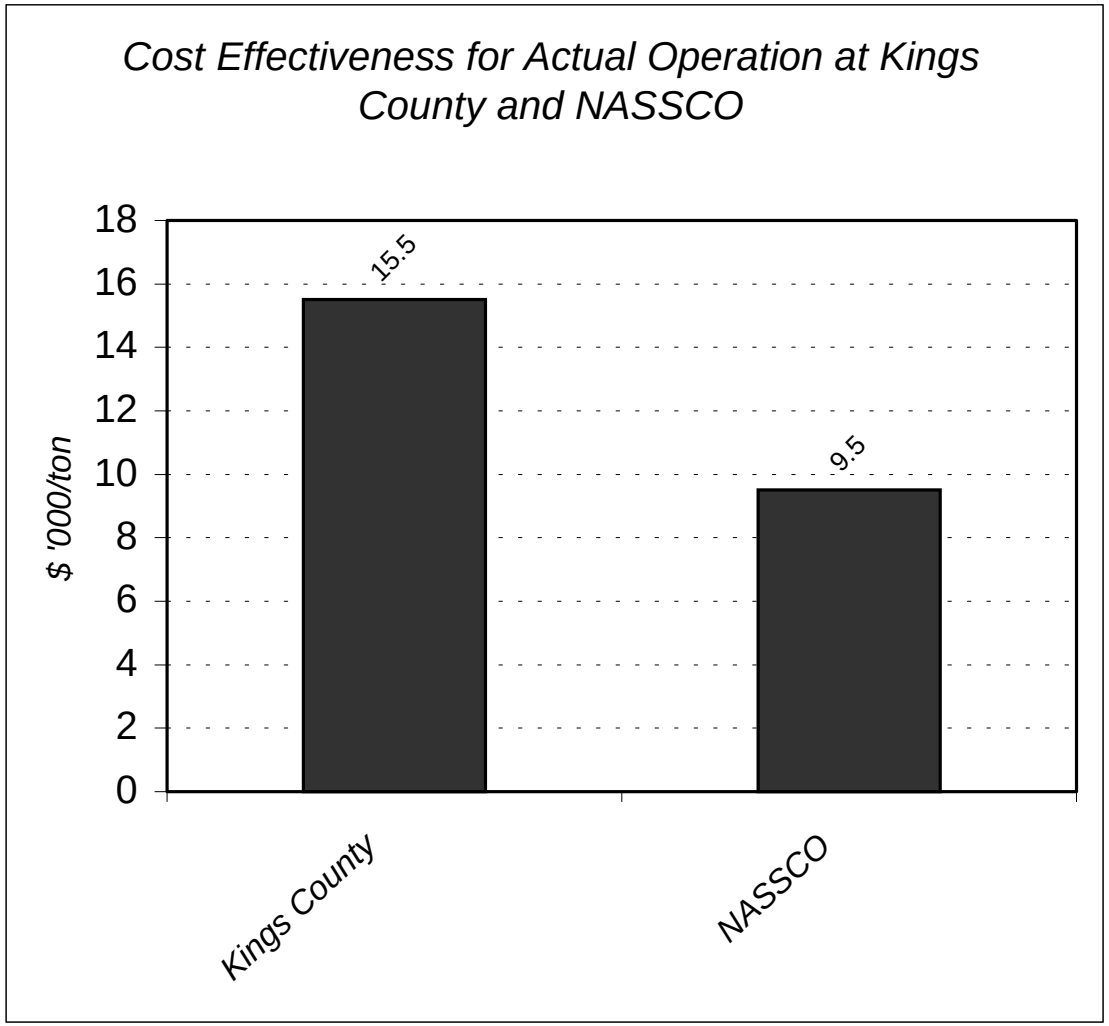
Case Studies



Policy Options

- RAP Model Rule
- OTC Model Rule
- RACT Rules
- NOx Budget Rule
- Encourage Green DG
- Work with ISOs - NEDRI
- Energy efficiency, clean DR